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Sensitivity Distribution of *Septoria tritici* Isolates to Flusilazole for Consecutive Years 1993, 1994 and 1995 in France, Germany and the United Kingdom†

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Abstract: Sensitivities of *Septoria tritici* populations to flusilazole were stable across Europe during the three seasons, 1993–1995 inclusive. © 1998 Society of Chemical Industry

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Key words: flusilazole; SBI inhibitor; *Septoria tritici*; sensitivity

1 INTRODUCTION

Sterol biosynthesis inhibitors (SBI) have been used extensively to control *Septoria* diseases of wheat throughout Europe for 20 years. The triazole flusilazole is a broad-spectrum, demethylation inhibitor, widely used for control of *Septoria tritici* Rob. and *S. nodorum* Berk. The adaptability of *S. tritici* necessitates a monitoring program to study the effects of selection pressure on the efficacy of flusilazole.

2 METHODS

Septoria tritici-infected leaves were collected in the years 1993–1995 from Germany, France and the United Kingdom. A novel, automated microtiter plate assay based on changes in optical density resulting from fungal growth was used to estimate growth of fungi isolated from the leaves, and provided a level of precision not obtainable with radial growth or minimum inhibitory concentration type assay.[1] Reference isolates RL2 and S27 were included in all assays for interpretive purposes. In order to measure within- and between-field variation, 10 leaves per field were randomly collected from each of 21 fields in 1994 and 1995. One single spore isolate was recovered from each leaf and assayed for sensitivity to flusilazole.

3 RESULTS

The cumulative results for 1993–1995 (Fig. 1) indicate a single, sensitive population with an EC_{50} value of 0·15 mg litre^{-1} ($\pm$0·02 mg litre^{-1}). The frequency distribution is normally distributed and appears to be relatively symmetrical. Distributions within individual years did not differ from cumulative results. Frequency distributions from the different countries also did not differ from the cumulative distribution (Fig. 2).

The level of field performance relative to in-vitro response is presented in Fig. 3. In development trials with naturally occurring infection, field efficacy was rated visually as percentage control on the flag leaf at approximately GS 75. Ten isolates from each field were tested *in vitro*, and the average sensitivity per field is represented by the bargraph. Field efficacy ranged

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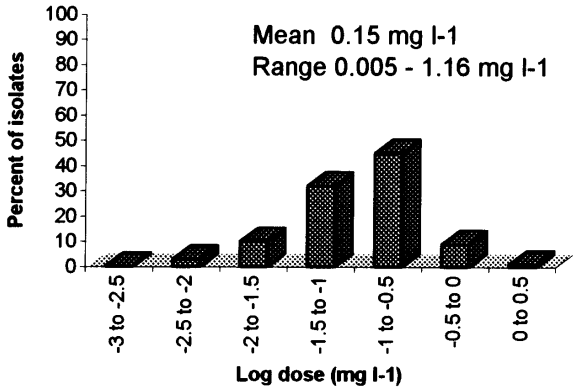

Fig. 1. Cumulative frequency distribution of the sensitivities of 443 *Septoria tritici* isolates collected in 1993, 1994 and 1995 across Europe to flusilazole.

from 70 to 90% control for these sites, and the range of mean in-vitro sensitivity values (0·09 mg litre^{-1} to 0·039 mg litre^{-1}) and field performance were not correlated ($r^2 = 0{\cdot}09$).

There was no change in mean sensitivity to flusilazole from 1993 to 1995 (Fig. 4). Average values varied by a

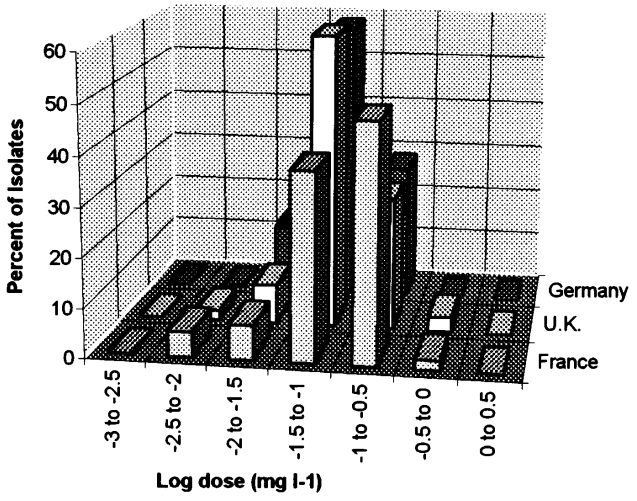

Fig. 2. Frequency distributions of flusilazole sensitivity by country.

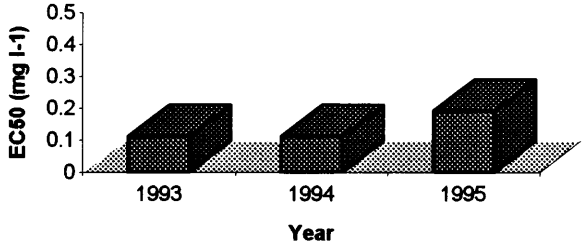

Fig. 4. Mean sensitivities to flusilazole for *Septoria tritici* populations collected in 1993, 1994 and 1995 across Europe.

standard deviation of 0·08 mg litre^{-1} in 1993, 0·11 mg litre^{-1} in 1994, and 0·15 mg litre^{-1} in 1995. In 1993 a total of 39 isolates were tested, 212 in 1994, and 234 in 1995 for a total of 443 isolates. Statistical findings and estimates are therefore considered robust. Sensitivity values for reference isolates RL2 (0·01–0·035 mg litre^{-1}) and S27 (0·16–0·22 mg litre^{-1}) encompassed the range of values typically seen in *S. tritici* populations, and provided distinct biological benchmarks at extremes of the testing spectrum.

Within-field variations in 1994 and 1995 were 0·08 mg litre^{-1} and 0·13 mg litre^{-1}, respectively, and exceeded between-field variation (0·07 mg litre^{-1}) in both years. Within-field variation accounted for 53% of the total variation, measured as variance, in 1994, and 75% in 1995. These data are consistent with reportedly high levels of genetic diversity in *S. tritici*.[2,3] Although there were a few EC_{50} values that were high relative to the mean, high in-vitro sensitivity values did not predominate in any field, in any year.

4 CONCLUSIONS

Septoria tritici population sensitivities were stable across Europe from 1993 to 1995 and no trend in decreasing sensitivity to flusilazole was apparent in the data. Frequency distributions were consistent with a single, sensitive population with no outliers or second-

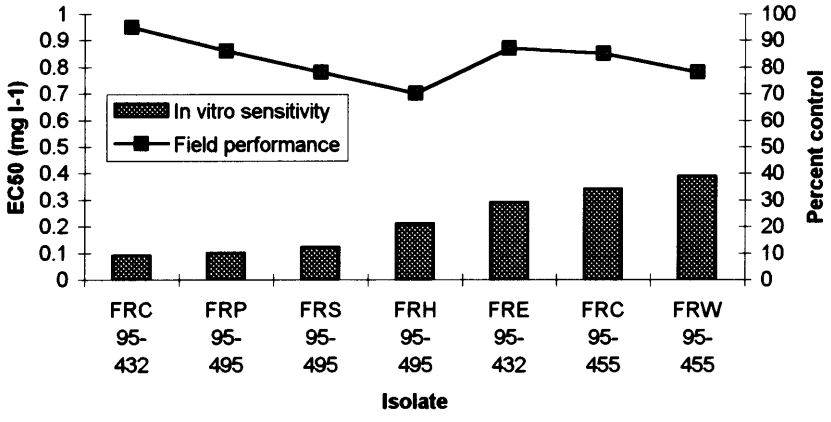

Fig. 3. Relative field efficacy of flusilazole against seven *Septoria tritici* isolates with differing *in vitro* sensitivities.

ary peaks. These data indicate that *S. tritici* populations were well controlled by flusilazole in the field, and that a long-term buildup of resistance is unlikely.

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